

NSRL Fault Studies

- ❖ Goals
- ❖ Layout
- ❖ Fault Studies
- ❖ Results
- ❖ Conclusions

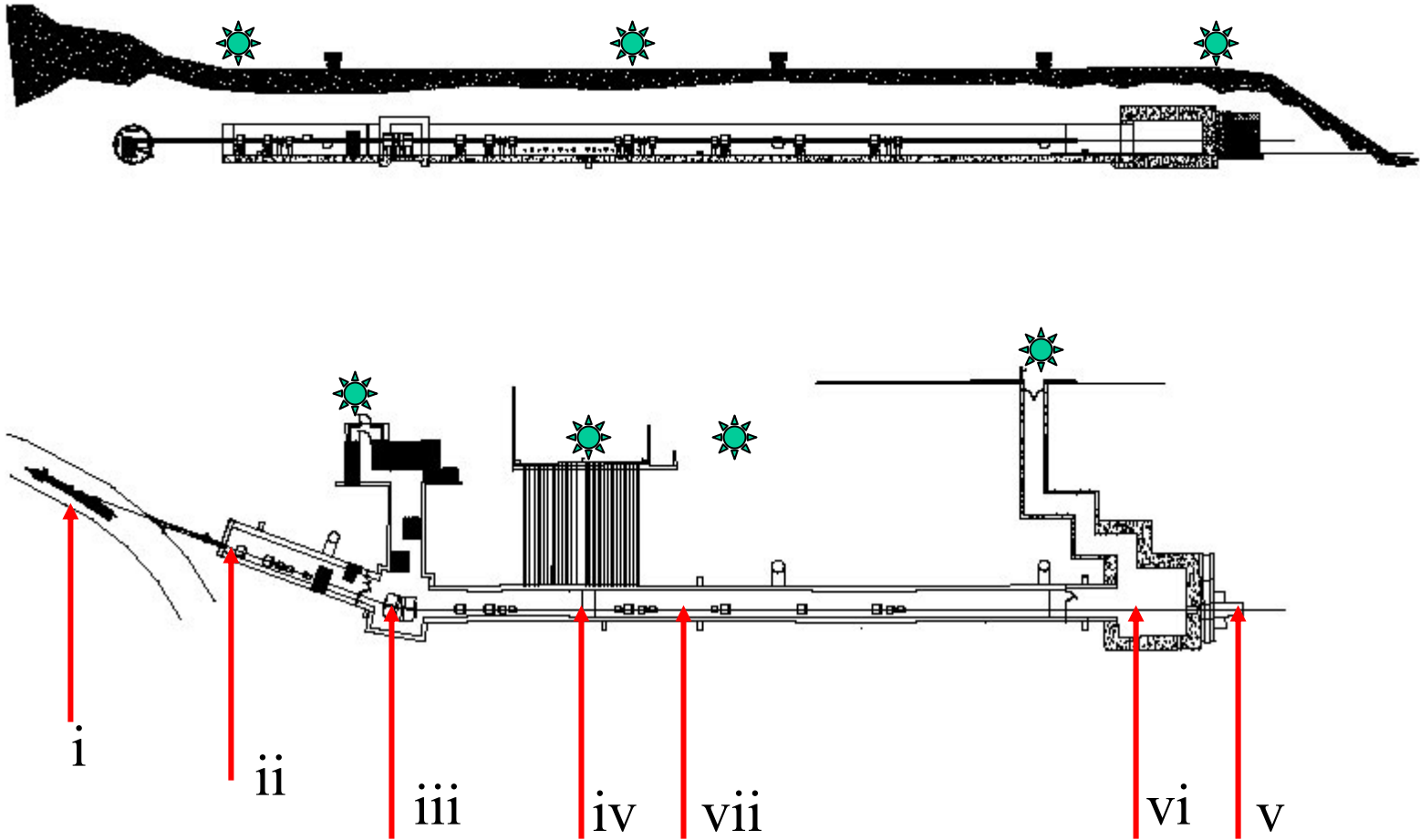
Fault Study Goals

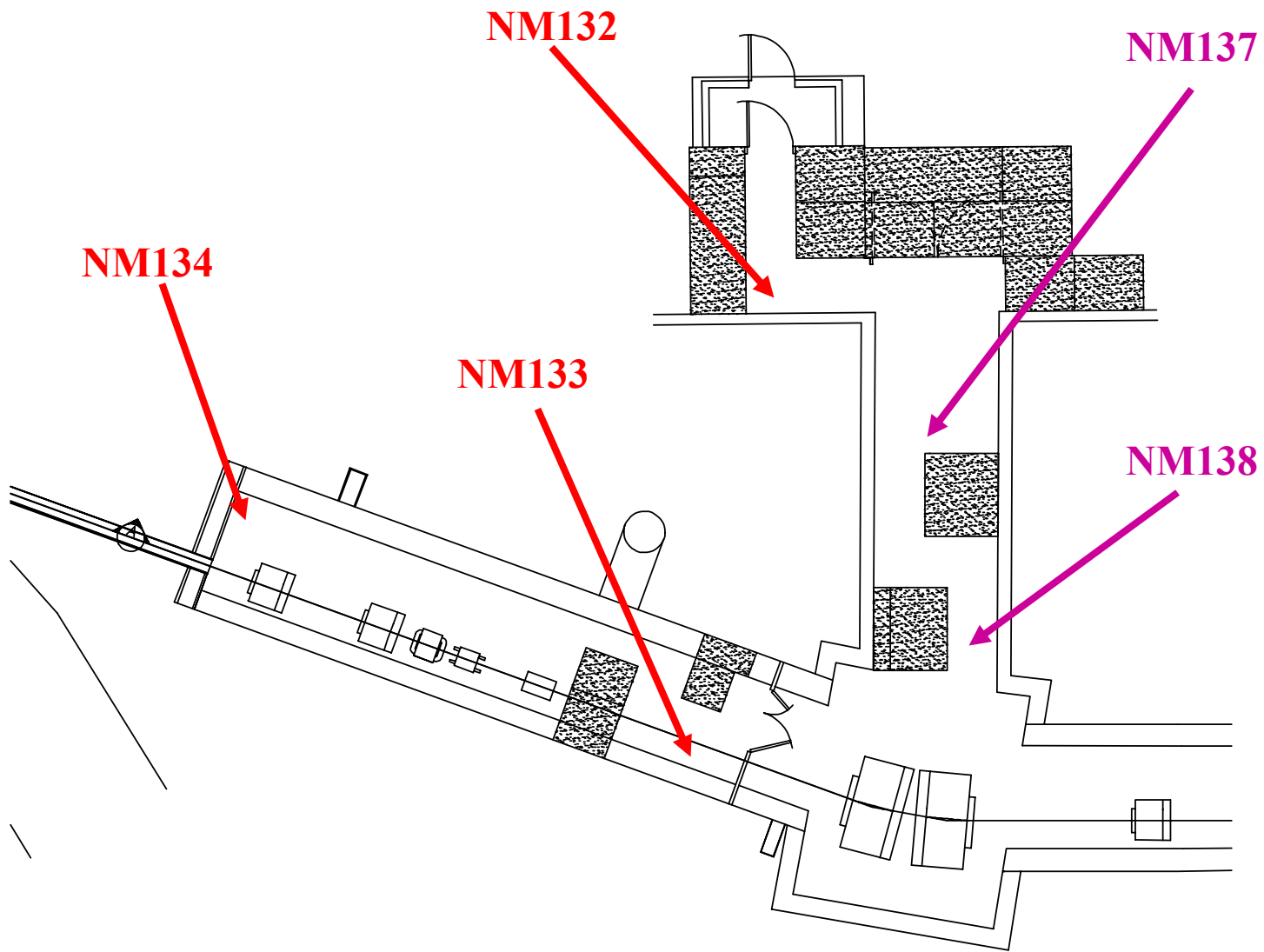
- ❖ Determine whether design provides adequate radiation protection for routine operation.
- ❖ Determine whether design provides adequate radiation protection to personnel during various faults.
- ❖ Determine whether the choice of monitor locations is optimum.
- ❖ Determine whether the monitors can be used to limit high-intensity protons delivery into NSRL.

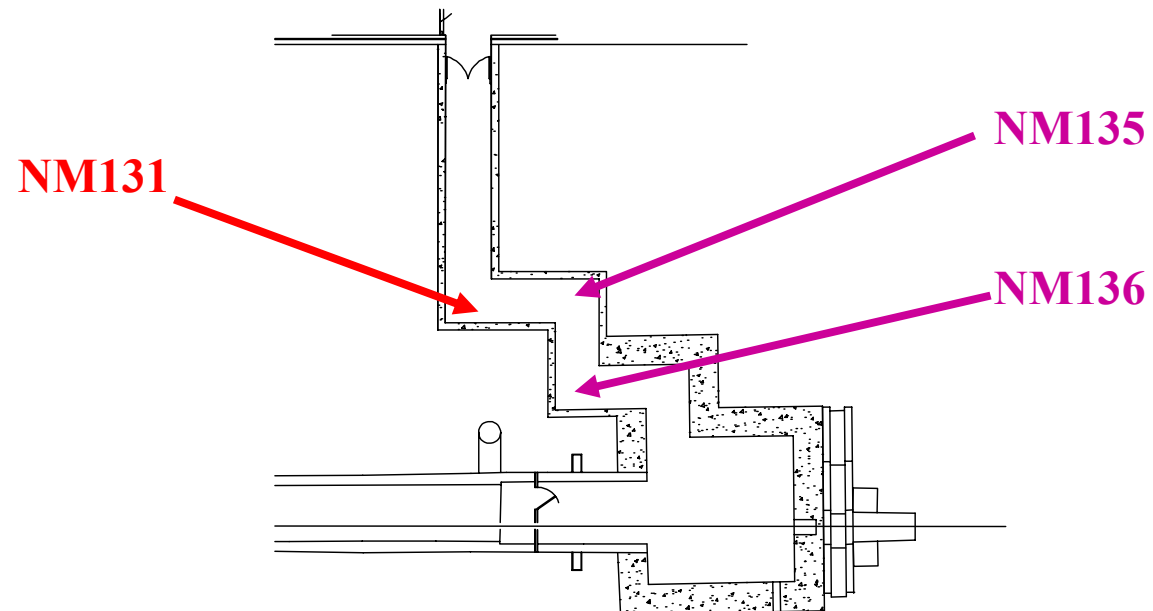
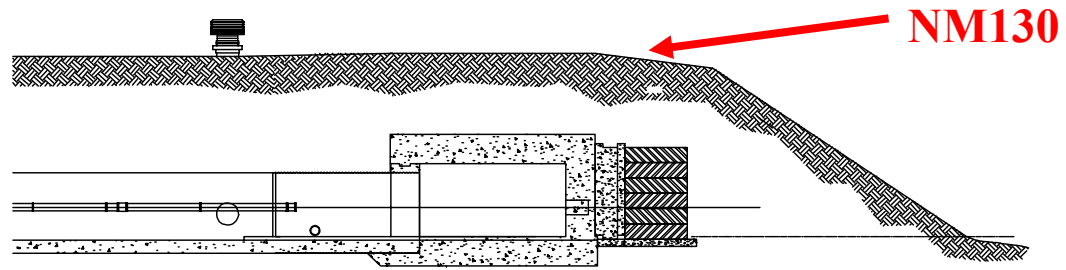
Fault Conditions, protons

- ❖ 2 GeV, $6 \times 10^{10}/5.4$ sec
 1. D6 Septum Magnet.
 2. Gate Valve in the Stub Tunnel at the Head Wall.
 3. RD1/RD2 Magnet (20° bend)
 4. Beam Pipe near the berm penetration
 5. Gate Valve past the berm penetration
 6. Thick Target in the target room
 7. Beam Dump (Routine Operation)
- ❖ Surveyed the berm, the fence, building 957 at the penetration, labyrinth entrances.

NSRL Layout

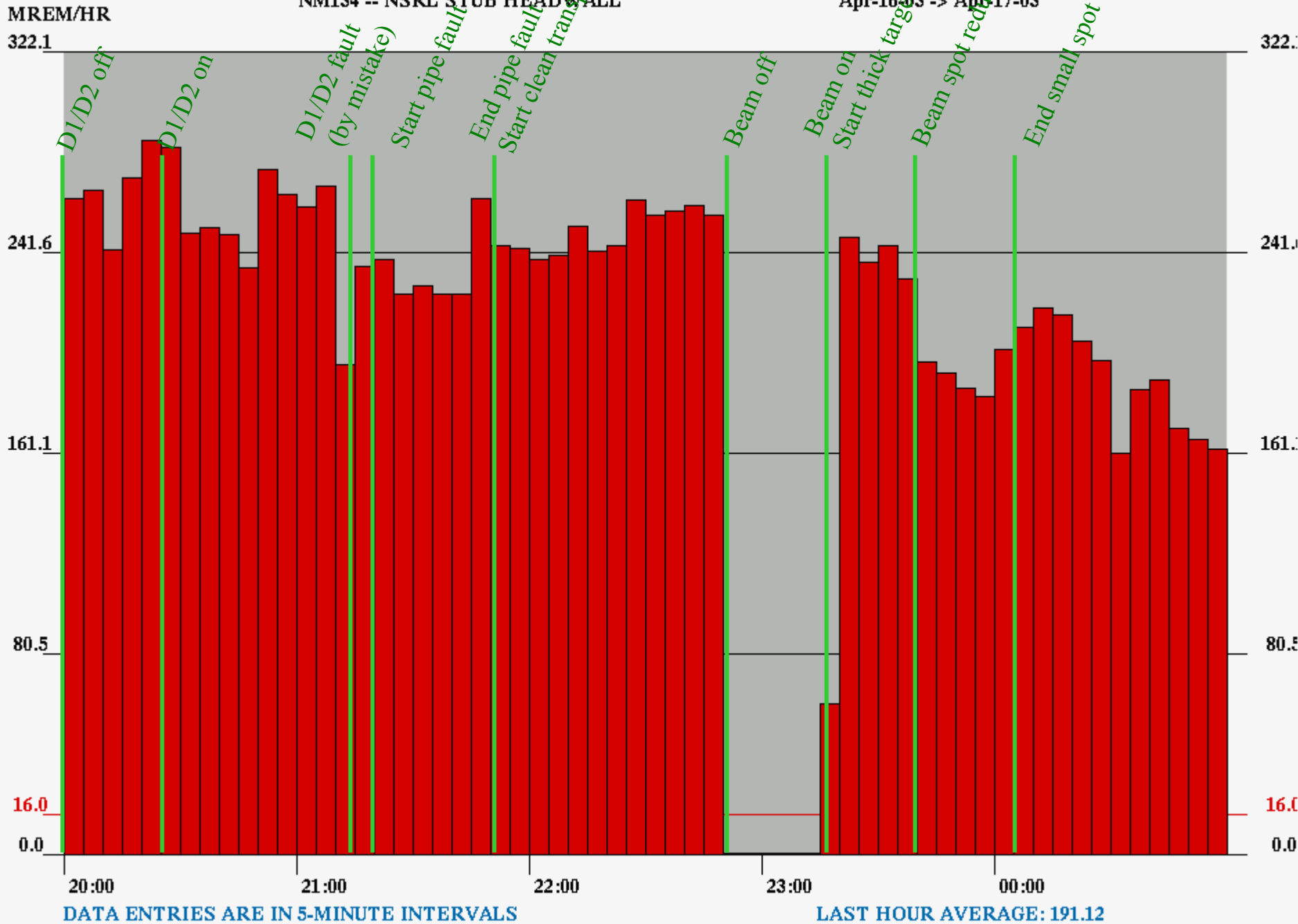


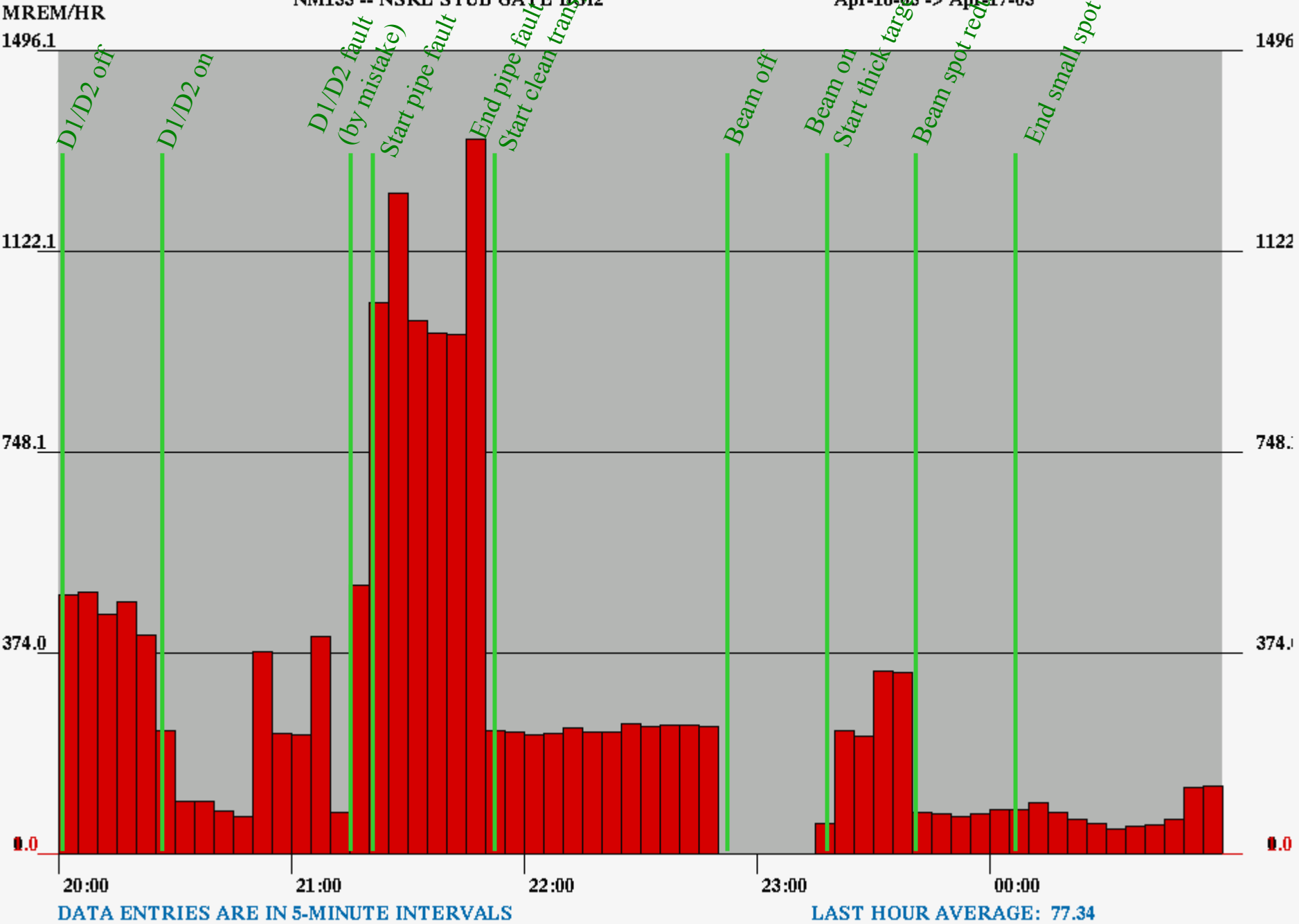


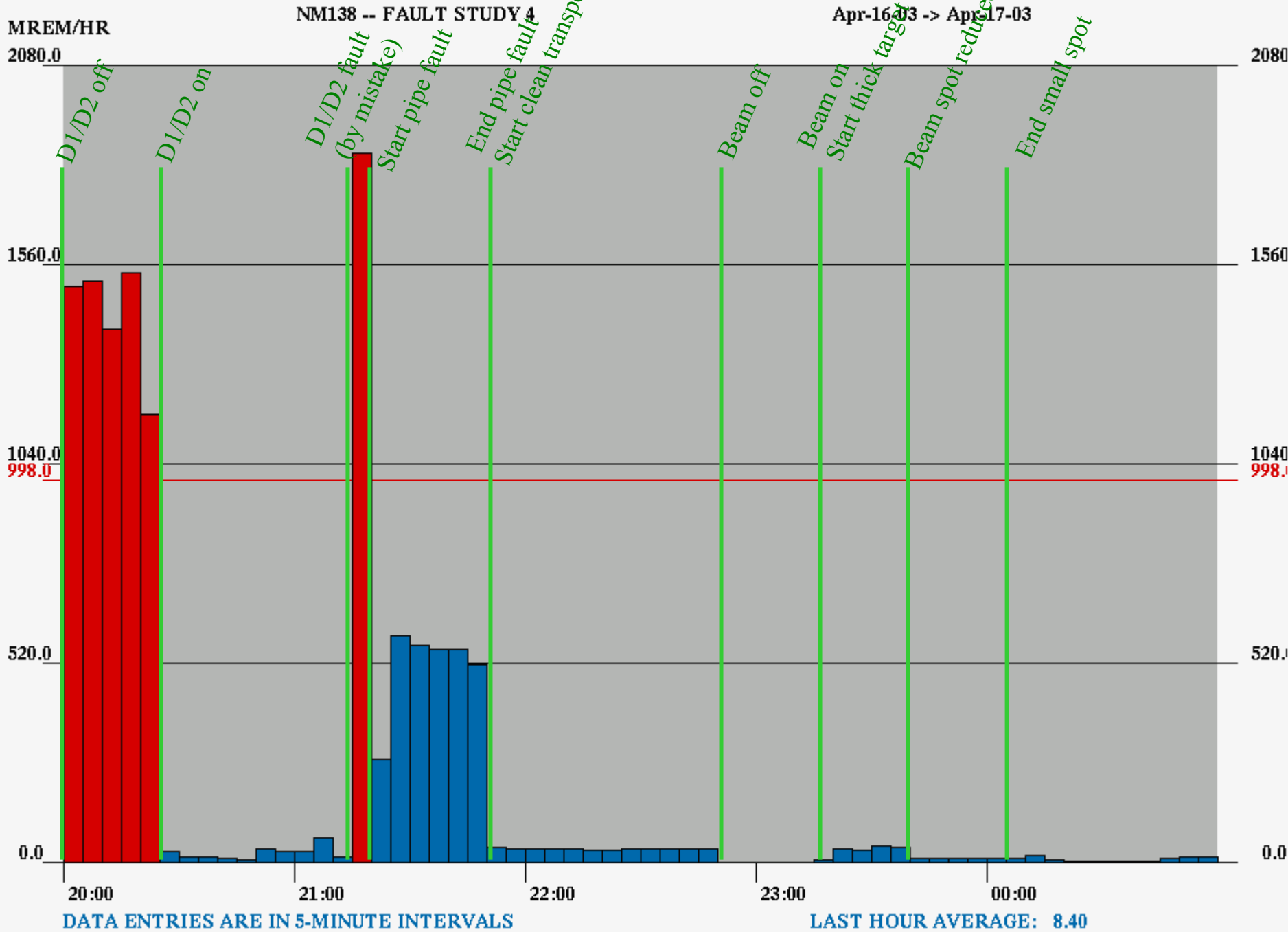


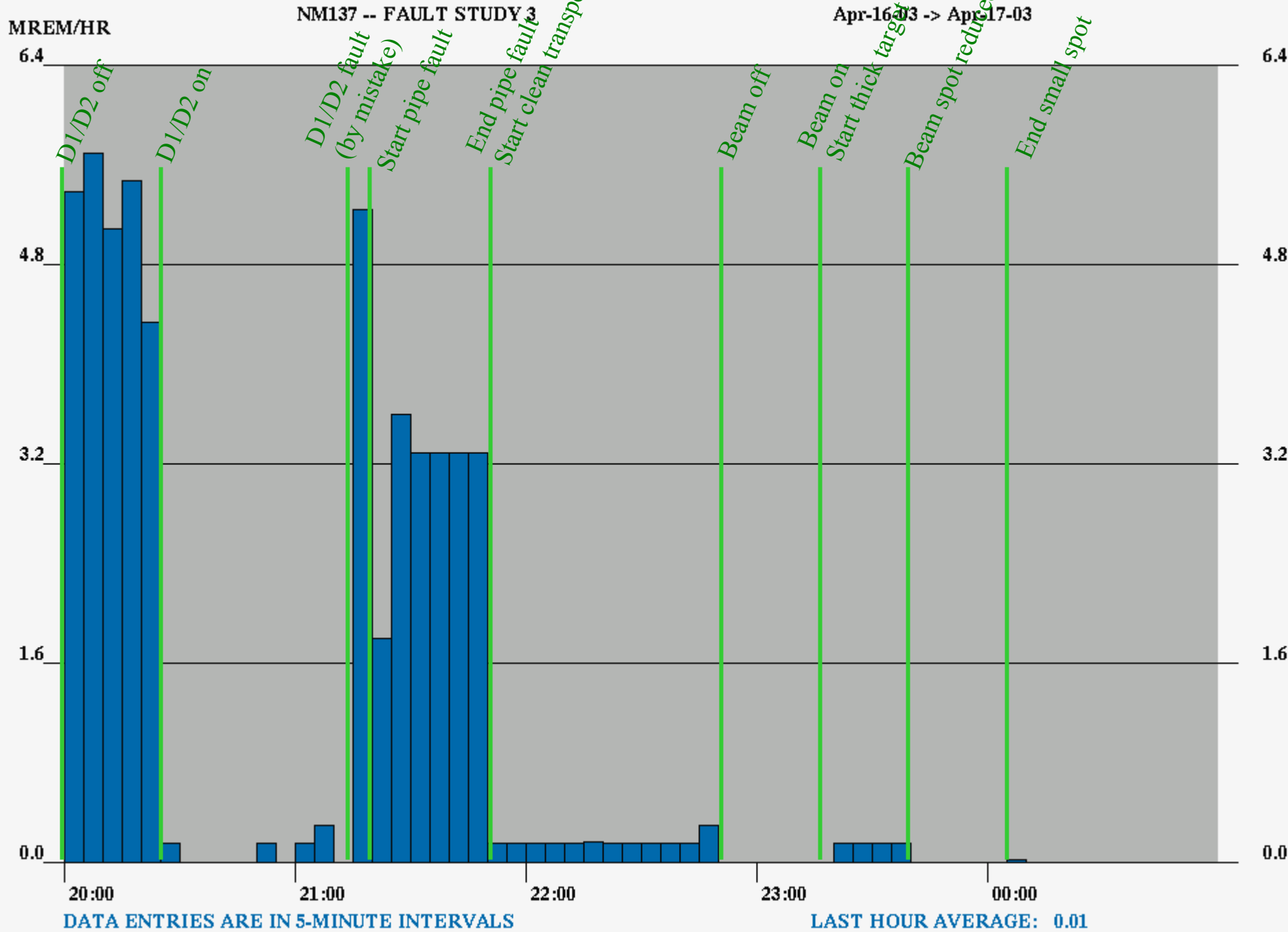
Results

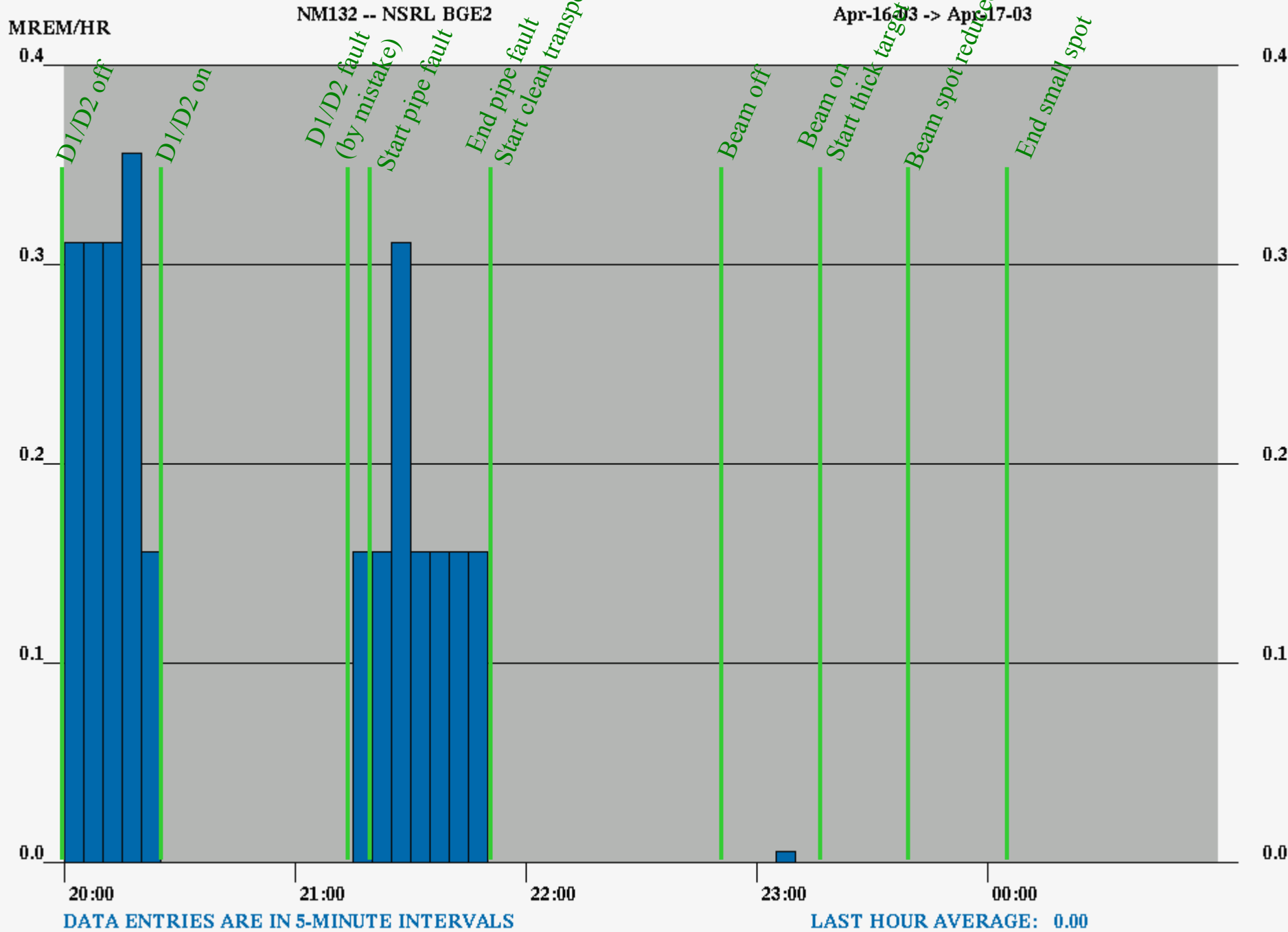
- The only dose observable with the hand-held instruments occurred in building 957 at the penetration, during the beam-pipe fault: 0.2 mrem/hour.
- Other measurements were made with the fixed monitors (chipmunks).







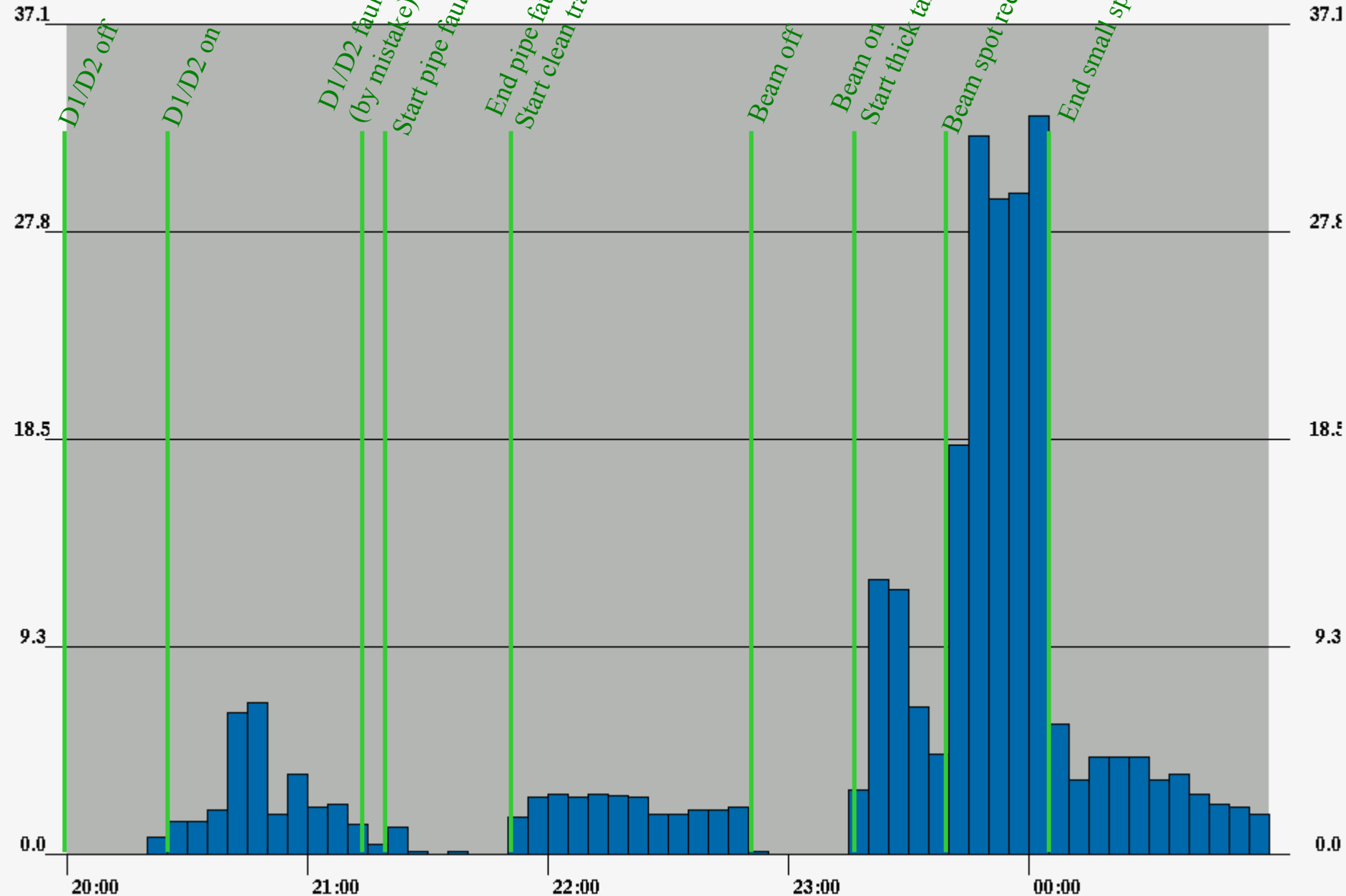




MREM/HR

NM136 -- FAULT STUDY 2

Apr-16-03 -> Apr-17-03



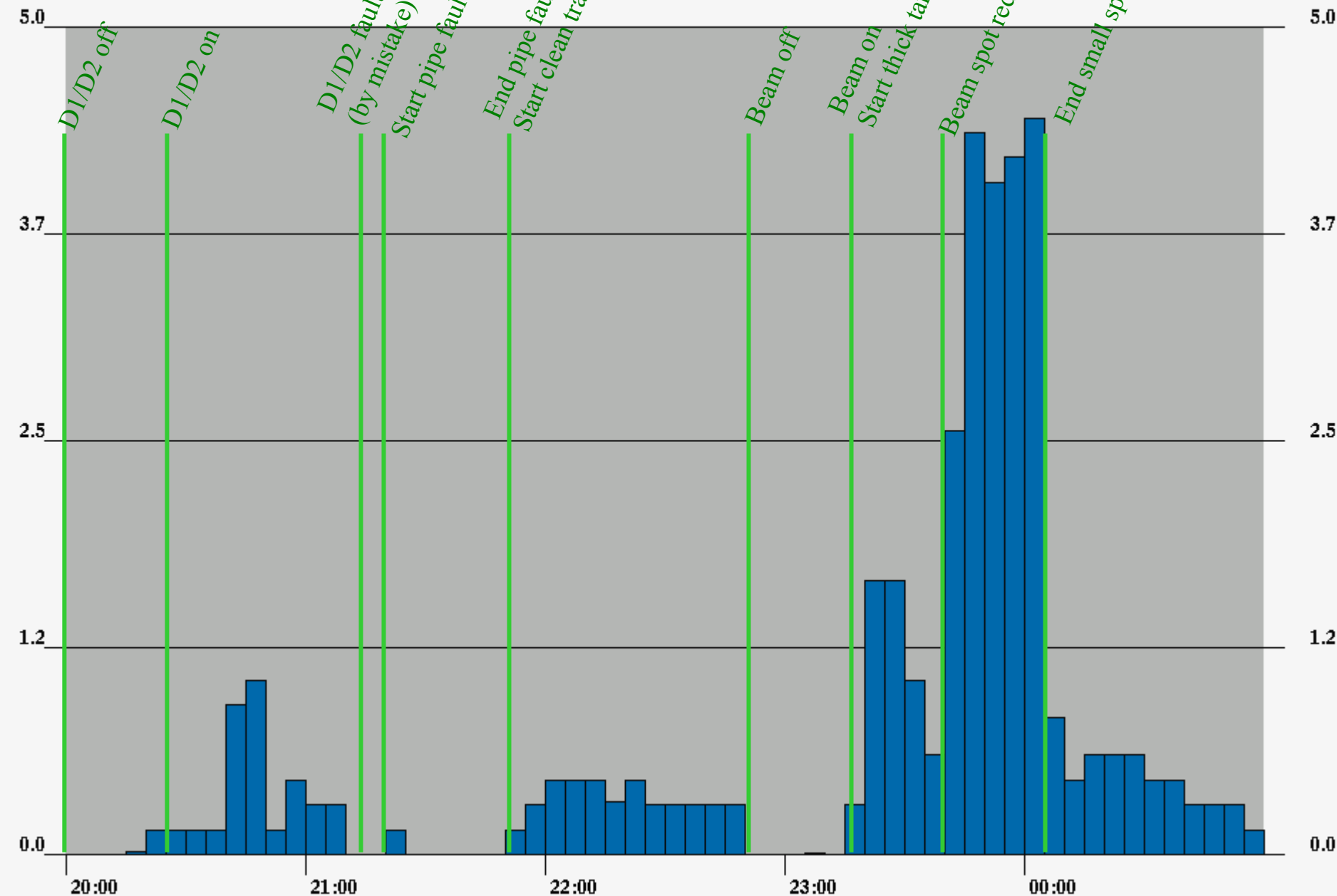
DATA ENTRIES ARE IN 5-MINUTE INTERVALS

LAST HOUR AVERAGE: 5.91

MREM/HR

NM135 -- FAULT STUDY 1

Apr-16-03 -> Apr-17-03



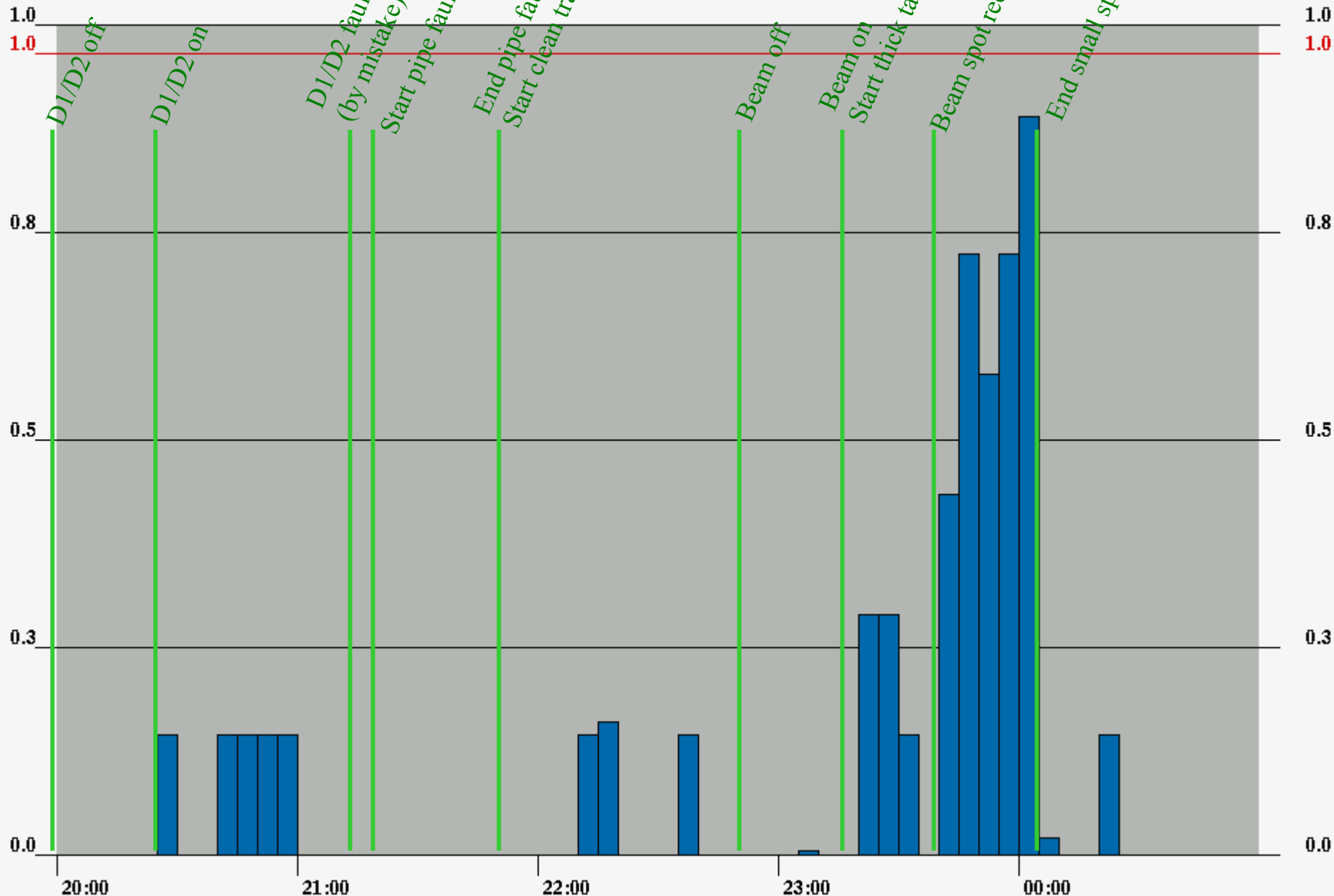
DATA ENTRIES ARE IN 5-MINUTE INTERVALS

LAST HOUR AVERAGE: 0.79

MREM/HR

NM131 -- NSRL TARGET LABY.

Apr-16-03 -> Apr-17-03



DATA ENTRIES ARE IN 5-MINUTE INTERVALS

LAST HOUR AVERAGE: 0.36

Trip Rates (2 GeV protons)

	D1/D2	Beam Pipe	Gate Valve	Thick Target	Beam Dump
NM130					
NM131			$4 \times 10^{11}/\text{s}$	$3.8 \times 10^{11}/\text{s}$	$5 \times 10^{11}/\text{s}$
NM132	$8.8 \times 10^{10}/\text{s}$	$1.8 \times 10^{11}/\text{s}$			$4 \times 10^{12}/\text{s}$

Rates During High Intensity Fault (3.7 GeV protons at $10^{14}/s$)

	D1/D2	Beam Pipe	Gate Valve	Thick Target	Beam Dump
NM130				5.0 rem/h*	5.0 rem/h*
NM131			1.0 rem/h	11.4 rem/h	2.5 rem/h
NM132	5.2 rem/h	2.5 rem/h	63 mrem/h	63 mrem/h	63 mrem/h

* Estimated, not measured

Dose During 5 second High Intensity Fault

	D1/D2	Beam Pipe	Gate Valve	Thick Target	Beam Dump
Upstream Labyrinth	7.2 mrem	3.5 mrem	0.1 mrem	0.1 mrem	0.1 mrem
Building 957		1.18 mrem			
Fence	1.6* mrem	1.6* mrem	1.6* mrem	1.6* mrem	1.6* mrem
Berm	25.7* mrem	25.7* mrem	25.7* mrem	25.7* mrem	25.7* mrem
Downstream Labyrinth	<0.8 mrem	<0.8 mrem	0.8 mrem	15.8 mrem	0.05 mrem

* Estimated

Conclusions

- ❖ Design appears to be adequate for routine operation.
- ❖ Protection under fault conditions is adequate.
- ❖ Chipmunks NM131 and NM132 in appropriate locations, and are set to appropriate trip levels. They will interlock at reasonable levels and will prevent multiple-spill high intensity faults in NSRL.
- ❖ Chipmunk NM130 will move to a location above mid-tunnel.